

CIRCULAR No. 24.

OLIVE PICKLING.

VALUE OF OLIVES AS FOOD.—GATHERING.—SORTING AND GRADING.—
PICKLING RIPE OLIVES: LYE PROCESS, WATER PROCESS.—PICKLING
GREEN OLIVES.—PRESERVING BY HEATING.—VARIETIES.

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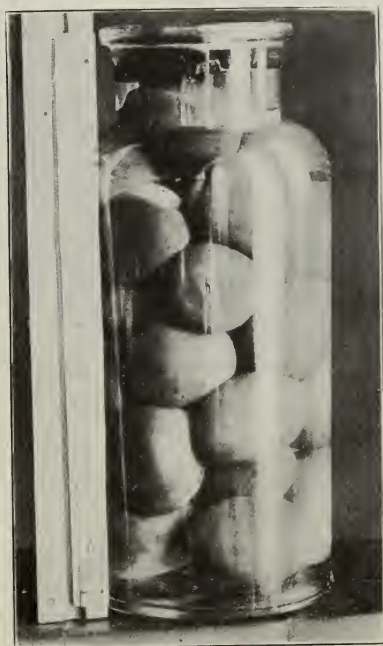


FIG. 1. Ascolano olives.

The increasing favor with which California pickled olives are received throughout the United States, and the consequent increase in demand, result in the receipt of a large number of letters by the Agricultural Experiment Station requesting information regarding methods of pickling. While no new experimentation has been undertaken in this matter by the Station since the appearance of the last bulletin on the

subject, the demand for information makes it desirable to publish a summary of the results obtained, as the editions of former bulletins are exhausted.

While undoubtedly improvements have been made during the last five years in the methods of pickling, more especially in the mechanical details, the essentials of the methods remain the same as when Bulletins Nos. 123 and 137 were published.

NUTRITIVE VALUE OF OLIVES.

Pickled *ripe olives* constitute an extremely nutritious and digestible form of food. They contain a large amount of oil, carbohydrates, and some nitrogenous matter, and in some countries replace meat to a certain extent. Pickled *green olives*, such as those imported from Spain, are, on the contrary, indigestible and contain much less nutriment. They are made from unripe fruit and are, therefore, as far as their use as food is concerned, in no way superior to unripe apples or peaches. They are simply a relish and to be used in very limited quantities in the same way as pickled walnuts or cucumbers. A meal of bread and ripe olives, on the other hand, is not only palatable, but nutritious and sustaining, and the amount eaten is to be limited only by the same considerations as that of any other good, wholesome food.

The following table of analyses, prepared by Professor Jaffa of this Station, illustrates very forcibly the superiority of ripe pickles over green in nutritive value:

Analyses of Edible Part of Ripe and of Green Pickles.

	Ripe Pickled Olives from California.			Queen Olives (green) from Spain.
	Medium-sized Mission.	Larger Watery Mission.		
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Water	64.72	65.45	72.77	78.41
Oil	25.89	25.15	18.81	12.90
Carbohydrates	4.28	3.22	2.49	1.78
Other matters	5.11	6.18	5.93	6.91

The Queen olives were the best of their kind to be found on the market, and when compared with the first two samples of ripe pickles, which are typical of good ripe Missions, show just one half the amount of nutritive material. This does not show the whole difference, for there is no doubt that the nutriment in the ripe fruit is in a much more readily assimilable form than in the green. The third sample was grown on an over-irrigated soil, and while inferior to the first two, is much superior to the green fruit in both quantity and quality of nutriment.

GATHERING THE OLIVES.

Whether olives are to be used for pickling or oil-making, it is very important that they should be picked carefully and at the right time. For green pickles they should be picked very soon after they obtain full size, but before they have begun to color or soften.

For ripe pickles they should be gathered at the same stage of ripeness as for oil-making; that is, when they contain the maximum amount of oil. This is soon after they are well colored, but before they have attained the deep black which signifies over-ripeness. If the olives are gathered too green the oil will be bitter; if too ripe, it will be rancid. On account of the different degrees of color in different

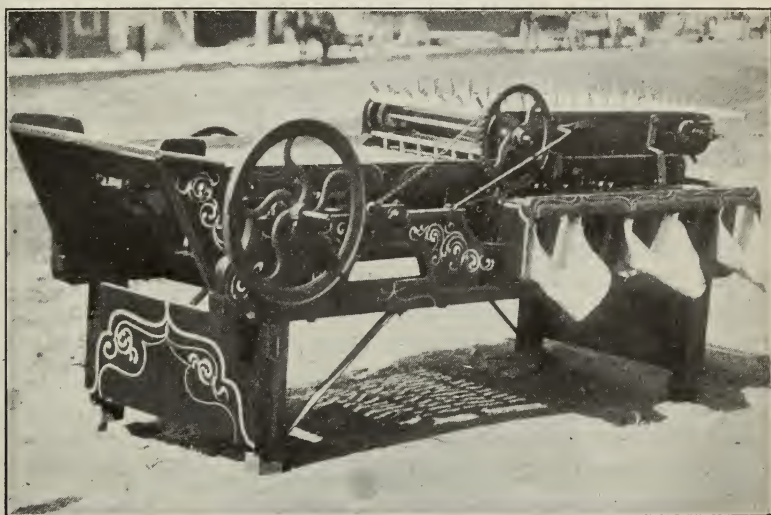


FIG. 2. The Garvin olive-grader.

varieties of olives, it is difficult to tell from their appearance when they should be gathered. When they can be easily shaken from the tree they are ripe enough. If they commence to fall without vigorous shaking they are over-ripe. For whatever purpose the olives are to be used they should be carefully gathered by hand. Rakes or sticks should never be used, as they bruise the fruit and break off a great many fruit-shoots needed for the following year. It is well to sort the olives as they are being picked, separating out the bruised, diseased, or under-ripe fruit.

GRADING AND SORTING.

It is extremely important that all the olives in each lot of pickles should be as nearly as possible uniform in character, in order to facilitate the process of pickling and to produce an attractive appearance. Olives of different varieties, and even those of the same variety from

dissimilar locations, should never be mixed. The first sorting is done while gathering, and the under-ripe, over-ripe, and injured fruit separated from that which is to be pickled. The good fruit is then graded according to size by means of a mechanical grader. In this way the olives are separated into different lots, which will each contain fruit on which the different processes of pickling will act uniformly. A grader adapted to handling soft fruit, that will not bruise the olives, must be used. That represented by Fig. 2 has been used successfully. After the pickling process is finished there will often be a distinct difference of color between different olives of the same lot. Another sorting according to color is then advisable. This must be done by hand, and either two or three colors may be separated—dark and light or black, medium, and greenish, according to the variety.

Unfortunately the consumer has acquired a taste for jet black olives and will accept a lighter olive only at a lower price. This has led to more or less questionable practices which have for their object the retaining of the natural dark color of some varieties, and the coloring of those which are naturally light in color. It is very seldom possible to put a perfectly black pickled olive on the market without the use of some dye or mordant, which, even if harmless, certainly does not improve the flavor or wholesomeness of the food. This practice would be unnecessary if the consumer could be taught that some of the best varieties of olives are naturally light gray or brownish green in color after pickling, and that any black olive is to be suspected of treatment with substances that are unnecessary for the production of the best quality.

PICKLING RIPE OLIVES.

The successful production of pickled olives is a matter of experience and depends almost altogether on the individual judgment and skill of the producer. No method can be given which is suitable to all cases, and the best method must be modified according to the nature of the olives to be treated. The following scheme, therefore, is to be considered as a mere outline, to be carefully adapted and modified by the operator at each stage of the process:

Lye Process.—1. Place the olives in a solution, composed of two ounces of potash lye to one gallon of water, for four hours. Repeat this once, or twice, *if necessary* to sufficiently remove the tartness.

2.* Rinse the olives thoroughly and replace the lye solution with fresh water. Change the water twice a day, until the potash has been removed from the olive, as judged by the taste.

3. Replace the water with brine composed of four ounces of salt to a gallon of water and allowed to stand two days.

*Professor Hilgard recommends the use of weak brine from the first; that is, as soon as the lye solution is removed.

4. Put in brine of six ounces of salt to a gallon for seven days.
5. Put in brine of ten ounces per gallon for two weeks.
6. Put finally into a brine containing fourteen ounces of salt to the gallon of water.

In order to make this process a success the following considerations should be kept in view:

1. Great care should be taken not to allow the olives to come in contact with anything that will injure their flavor. The vats or other receptacles used for pickling should be perfectly clean, odorless, and tasteless. Earthenware is the best material, but it is usually cheaper and more convenient to use wooden receptacles thoroughly treated with boiling water and soda until they are sterilized and all taste of the wood removed. Any wood (such as pine) with strong taste should not be used. The vats should be provided with a removable wooden grating, fastened one or two inches from the bottom, and a close-fitting, floating wooden cover to prevent access of air, which spots the fruit. On top of the vats should be placed a cover of thick cloth or of wood to exclude the light and dust. Each vat should be provided at the bottom with a wooden spigot for drawing off the solutions. The thickness of the layer of olives should not be more than two feet, or less with soft varieties.

2. It is best to use good potash lye. Some of the brands of lye are so impure that it is impossible, without a chemical analysis, to tell within forty per cent how strong the lye solution actually is when made up. "Greenbank lye" has been found the most reliable, and may be considered as one hundred per cent pure when making up the solution.

Impure lyes are often used with success, but it is necessary to use more of them. The principal adulterant is common salt, and if soft or over-ripe olives are being pickled this may be an advantage, as it keeps the fruit firm. If we have pure lye, however, we can add the salt if necessary and leave it out if we do not need it. As salt is much cheaper than lye it is better to buy it separately and not to pay the price of lye for it as we do when we buy impure grades.

The length of time which the olives should be left in the lye, and the number of times the lye should be renewed, can only be determined for each variety and each locality. The object is to extract the tartness of the olive, and at the same time to soften the skin sufficiently to allow the tart or bitter substances to be soaked out in the subsequent treatment with pure water. The tougher and thicker the skin of the olive, and the more intense the tartness, the longer must the lye treatment be continued. The lye is sometimes made twice as strong as recommended above, and the treatment correspondingly shorter, but the results are not so good. Just enough lye solution should be used to exactly cover the olives, and occasionally, during the soaking, some

of the solution should be drawn off below and poured on top to insure an equal treatment of all the fruit.

3. Only the very purest water should be used, both for the lye solution and for the subsequent soaking. Canal and river water, or any water that contains a great deal of organic matter, should never be used, unless it is practicable to boil it first. Distilled water, such as can sometimes be obtained by condensing the waste steam from a boiler, is the best, on account of its purity and its greater extractive power, provided of course it be free from oily flavors. The length of time during which the soaking in pure water should be continued varies very much in accordance with the character of the fruit. If the olives are firm and show no signs of becoming soft it should be continued until the tartness is sufficiently extracted. This will vary usually between ten and twenty days. The moment that the olives begin to

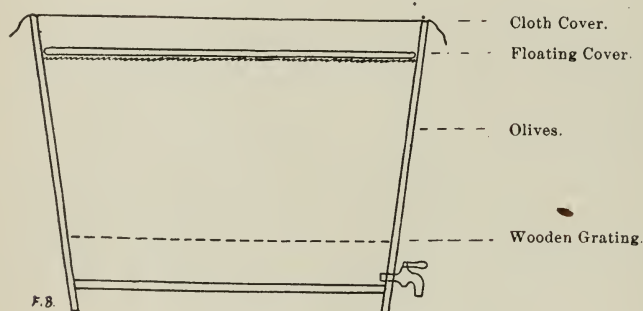


FIG. 3. Pickling vat.

show signs of softening, however, they should be placed in weak brine, even though the tartness has not all disappeared. What remains can then be extracted by the brine, which should be changed two or three times, as may be necessary. It is not necessary to change the brine quite so often as the pure water, once in two days being generally sufficient.

If the olives are soft at first, before treatment with lye, or if they are of a kind that softens rapidly in the lye, it is necessary to use brine from the beginning, either immediately after treatment with lye, or, in extreme cases, with the lye. This method, suggested by Professor Hilgard, has been used with marked success. The lye solution in this case should be made by adding two ounces (or less, if the olives are not very bitter) of lye and four ounces of salt to each gallon of water. As the lye acts much more slowly when used in combination with salt, it may be allowed to stay on the olives for a longer time without injury—eight to twelve hours, or even more. This lye and salt solution tends to harden and shrink the olives. The shrinkage, which occurs when brine is used from the beginning on naturally soft olives, is not a disad-

vantage if not carried too far, as such olives are generally too watery to be palatable or to keep well. They can, moreover, if shrunk too much, be made plump again by a few treatments with pure water before being put finally into brine.

The first salting must be done very gradually and carefully, in order to prevent shrinkage and wrinkling of the fruit. For this reason, gradually increasing strengths of brine must be used, as described, and the olives left long enough in each to be thoroughly penetrated.

In these operations no sign of scum or slime should be allowed to accumulate on the olives, the vats, or the covers. This is of especial importance during the treatment with plain water. On the first signs of sliminess around the sides of the vats, where it appears first, the latter should be emptied and thoroughly brushed and scalded before replacing the olives.

Pure-Water Process.—The best pickled olives are made without the use of lye, but this process is only practicable with olives such as Ascotano and Columbella, the tartness of which is easily extracted, and where the water is extremely pure and plentiful, and even then it is very slow and tedious. It differs from the last process only in omitting the preliminary lye treatment. The olives are placed from the beginning in pure water, which is changed twice a day until the bitterness is sufficiently extracted. This requires from forty to sixty days or more. The extraction is sometimes hastened by making two or three shallow, longitudinal slits in each olive; but this modification, besides requiring a large amount of expensive handling, renders the fruit peculiarly susceptible to bacterial decay and softening.

PICKLING GREEN OLIVES.

Green olives can be, and have been, pickled in California by exactly the same methods used for ripe olives, and when treated in this way leave nothing to be desired as regards flavor and keeping qualities. They have, however, the defect, fatal commercially, of losing their bright-green color during the process of pickling, or shortly afterwards. Practically all the unripe olives prepared in California turn an unsightly brown or gray, and have for this reason been unmarketable in competition with the imported Spanish olives, which usually retain their bright-green or yellowish-green color, even when taken from the brine and exposed to the air for a considerable time on the counters of the grocers. In spite of the opinions of connoisseurs and of the analyses of chemists, which show that the ripe pickled olives are not only more pleasing to the cultivated palate, but also more digestible and nutritious, the fact remains that the favorite olives with the average consumer, and those for which the trade can afford to pay the highest price, are the

large green "Queen" olives of Spain. These are the product of several large-fruited varieties, pickled (when green) by processes which are trade secrets of the Spanish producers, or which, having been devised for local conditions, are inapplicable here. The finest and largest are made from a variety called Sevillano, though other large kinds are used; and doubtless any large olive such as Macrocarpa, True Picholine, Santa Catarina, and Ascolano, could be successfully marketed, if cured in the same way. Now that these varieties are beginning to be produced in California in notable quantities, it is important that some way of preparing them should be found that will enable them to hold their own against their imported rivals.

A series of experiments, detailed in Bulletin No. 137 of this Station, demonstrated that it is possible to produce green pickled olives which will retain their color for at least twelve months by the lye-and-salt method of treatment, if properly modified and controlled. The color is preserved, so that exposure to the air *after* the completion of the pickling process does not seriously affect the color for some time. The following process, based on these experiments, is recommended:

Choice of Fruit.—Only large-fruited varieties should be used, as the small green pickles bring a very inferior price. The olives should be gathered as soon as they have reached full size and before they have colored notably. A slight pink color on one side does little harm, as it disappears during the process, but olives which have reached the stage of ripeness indicated by this first change of color will probably have less of the bright green than if gathered earlier. No two varieties should be pickled together, and the olives should be graded into three or four sizes. The reason for this is that different varieties and different sizes are almost sure to require different strengths of lye solution, and it is therefore impossible to attain the best results unless this selection is made. The proper strength of lye solution to use in each case is best determined by a preliminary trial, as follows:

Preliminary Trial.—Take a series (about six) of pint preserving jars and fill them with the olives to be tested. Pour into them, respectively, a $\frac{1}{2}\%$, 1%, $1\frac{1}{2}\%$, 2%, $2\frac{1}{2}\%$ and 3% lye-solution, sufficient to completely cover the fruit. At the end of forty-eight hours examine them. (It has been found that a sufficiently strong lye-solution will extract the acid and bitter principles of even very bitter olives in forty-eight hours.) At the end of this time some of the weaker lye-solutions will be found to have been neutralized; that is to say, all the lye will have been used up in acting upon the acids of the fruit. This will be made evident by the lack of the slimy feeling which the fingers have when dipped into a lye-solution and rubbed together. Suppose that the $\frac{1}{2}\%$, 1%, and $1\frac{1}{2}\%$ solutions are neutralized, and that the 2% still has a slight slimy feel-

ing. This will show that a 2% solution is a little stronger than is necessary to neutralize all the bitter or acrid matters in the sample tested. If, now, we use a 2% solution in curing the bulk of the olives from which the sample was taken, we are able to preserve the green color perfectly. If we use a somewhat stronger solution, say a 2½%, the color will bleach out a little; while if we use a much weaker solution, say a 1%, the green will change to that disagreeable gray or brown which we wish to avoid.

Process.—The appropriate strength of lye-solution having been determined, the olives are placed in convenient receptacles, where they can be treated with a minimum exposure to the light and air. For this purpose fifty-gallon barrels with very large bungholes (four or five inches in diameter) and spigots are useful. After filling the barrels with olives, the lye, of the strength determined in the preliminary trial, is poured in. Each barrel should be quite full of olives, and sufficient lye-solution should be put in to come flush with the bunghole. At the end of forty-eight hours the lye should be drawn off, the olives quickly washed with two changes of fresh water, and the barrels filled immediately with a 2% salt-solution. This brine should be replaced successively with a 4% and 8%, and finally a 12% solution, in the last of which the pickles remain permanently. The successive brines should be allowed to act for from forty-eight to seventy-two hours each, according to the size of the olives; the larger sizes requiring more time for the brine to penetrate and to displace the excess of lye which remains. The whole process will thus take from ten to fourteen days.

Absence of Air.—The essential part of the process is to avoid exposing the olives to the air during the pickling, until all the bitterness and acid are completely neutralized by the lye. After this the green color seems to be fixed, and exposure to the air does not change it much, though it is well, all through the process, to avoid leaving the olives uncovered by liquid any longer than necessary.

As different varieties of olives, and even the same variety in different seasons and from different localities, differ very much in bitterness, the importance of treating each variety separately is evident, as each will require lye-solutions of different strength to neutralize it. Very bitter olives, such as Mission, Sevillano, Manzanillo, and True Picholine, require solutions containing from 1½% to 2% of pure potash lye, while olives containing little bitterness, such as Ascolano and Columbella, require only from ½% to 1% solutions. As many of the commercial lyes are far from pure, some containing not more than fifty per cent of potash, the number of preliminary tests must usually be at least six, as indicated above. Preliminary tests conducted as described do not require an analysis of the lye, though it is probable that lyes contain-

ing a large amount of common salt would act more slowly; and with such lyes a treatment exceeding forty-eight hours might be necessary.

To facilitate the preparation of the different strengths of solutions, it is convenient to remember that, as a gallon of water weighs 128 ounces, one and a quarter ounces of solid lye to the gallon of water is equal (in round numbers) to one per cent; or that one pound of such lye will make twelve and a half gallons of one per cent solution.

PRESERVING OLIVES BY HEAT.

However carefully the processes of pickling are carried out the olives will only keep for a limited time. They usually remain in good condition for about six months when kept in a strong brine, and the best may last in fair condition for a few months longer. Few olives are good when kept in the ordinary way for twelve months. By that time they usually become moldy or slimy, or acquire a disagreeable decayed taste or smell, even when the brine contains 12% of salt.

It was shown by the experiments detailed in Bulletin No. 137 that by a proper heating of the olives after pickling their keeping qualities could be much improved. Ripe pickled olives, heated to 175°F., kept perfectly for thirty-two months. By heating them still higher in sealed cans or bottles they can be kept indefinitely with as great facility as any other food product. The heating does not injure the flavor and the texture, but, on the contrary, improves them. Olives preserved by heating do not require such strong brine, and it is only necessary to add as much salt as the palate requires. Ordinary olives require soaking to remove part of the salt before they are eaten. The heating causes some of the coloring matter to diffuse out into the brine, so that the olives are made a little lighter colored. With time, however, the coloring matter diffuses out in the same way from unheated olives, so that at the end of a year the heated olives are actually darker in color than the unheated.

VARIETIES OF OLIVES FOR PICKLING.

The commonest variety of olive grown in California both for oil and pickles is the Mission, so called because it was the variety found in the gardens of the old Spanish missions. It is hardy, a regular bearer, and less subject than other large varieties to dry and soft rot. It has the deep color and typical pointed olive shape which the market prefers. It is smaller, however, and of poorer quality as a pickling olive than several other varieties which have done well in a few orchards in California.

The largest olives of all are the Ascolano and the Sevillano. The former is an Italian olive as large as a French prune and very much like one in shape and appearance. It makes a ripe pickle of excellent

quality, but is lacking in color. When pickled green it is too pale in color, but this might be remedied by gathering more unripe.

The Sevillano is the Spanish variety from which the best "Queen" olives of Spain are made. It is almost as large as the Ascolano, and has the advantage of deep black color and typical olive shape. In appearance it resembles a very large Mission olive. It is most excellent for both ripe and green pickles, though a little inferior in flavor to the Manzanillo and the Gordal.

Next in size to these two are the Macrocarpa, Polymorpha, Picholine d'Aix, and Amygdalina. These are intermediate in size between the



FIG. 4. Mission. (Single olive, natural size.)

Sevillano and the Mission. The first two are very subject to soft rot, and the last has been tested very little here. The Picholine d'Aix is apparently the best of the four, and makes an excellent ripe pickle. It has a very free pit and is used in France for making stuffed olives.

The Obliza, Manzanillo, and Gordal have been tested in various localities and in a few have given satisfaction. The first two are subject to soft rot in the interior valleys. The last two produce ripe pickles of the best quality, being superior in flavor and texture to any which have been tried in California. They are about the same size or a little larger than the Mission, but are not of so desirable a shape. The Manzanillo especially, as its name indicates, is short and apple-shaped.



FIG. 5. True Picholine.



FIG. 6. Ascolano.



FIG. 7. Sevillano.

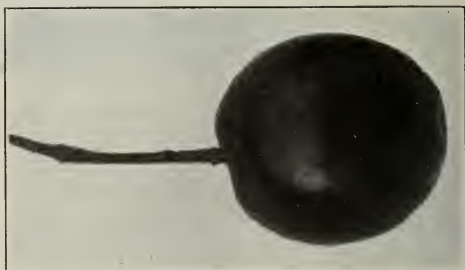


FIG. 8. Manzanillo.

(Figs. 6, 7, 8, natural size.)



FIG. 9. Mission.



FIG. 10. Sevillano.

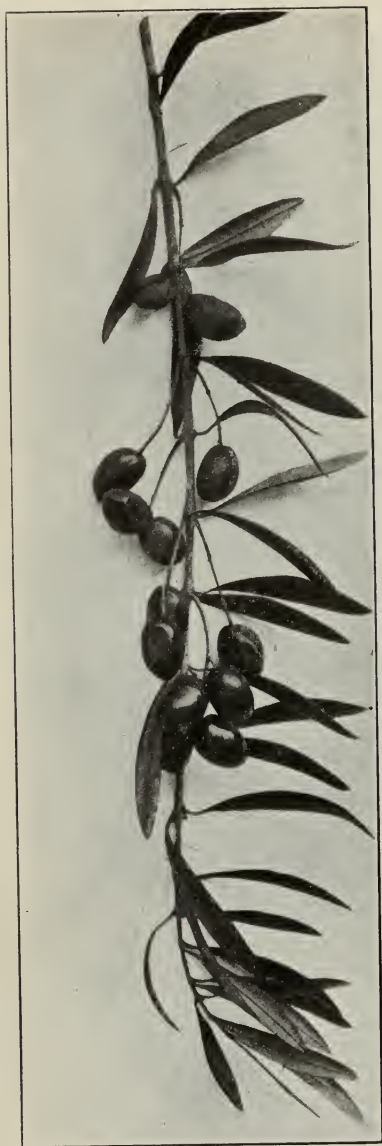


FIG. 11. Nevadillo.



FIG. 12. Polymorpha.